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(54)【発明の名称】 加熱装置

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(57)【特許請求の範囲】

【請求項1】 流動性を有する飲食物を管路内に連続的に案内しつつ前記管路内でジュール熱により加熱する加熱装置であって、絶縁性の案内面を有する筒体に前記案内面に対応した案内面を有する環状の電極が設けられた加熱ユニットと、当該加熱ユニットの下端部に接続され当該加熱ユニット内に前記飲食物を供給する流入管路と、前記加熱ユニットによりジュール加熱された飲食物を流出させる流出管路と、前記加熱ユニットを傾斜させて支持する支持部材とを有し、傾斜された状態の加熱ユニット内を飲食物を前記加熱ユニットの下端部から上端部に向けて上昇移動しながら加熱するようにしたことを特徴とする加熱装置。

【請求項2】 流動性を有する飲食物を管路内に連続的に案内しつつ前記管路内でジュール熱により加熱する加

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熱装置であって、絶縁性の案内面を有する筒体に前記案内面に対応した案内面を有する環状の電極が設けられた加熱ユニットと、当該加熱ユニットの下端部に接続され当該加熱ユニット内に前記飲食物を供給する流入管路と、前記加熱ユニットによりジュール加熱された飲食物を流出させる流出管路と、前記加熱ユニットをその上端部または下端部で傾斜角度を調整自在に支持する支持部材とを有し、飲食物の特性に応じて前記加熱ユニットの傾斜角度を調整し得るようにしたことを特徴とする加熱装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は飲食物を加熱する技術に  
関し、特に、粘性が高い飲食物や野菜等の固形物が含ま  
れた粘性の高い飲食物、あるいは流動性を有する物質を

主成分とする飲食物等の加熱に用いて有用な加熱技術に関する。

【0002】

【従来の技術】ジュース、スープ等のような液状の飲食物、味噌や練りからし等のペースト状食品、さらにカレールー、ビーフシチュー等のように野菜や肉等の固形物を含む液状ないし半固形状の食品のような流動性を有する飲食物を調理したり、殺菌のために加熱する場合には、通常、収納容器内にこれらの流動性を有する飲食物を収容した状態で、蒸気、ガス、あるいは湯煮等を熱源として、収納容器を加熱するようにしている。

【0003】このように、収納容器を加熱することにより収納容器を介してこの収納容器内部に収容された飲食物を加熱する場合には、飲食物つまり被加熱物はそれ自身の熱伝導により加熱されることになるので、収納容器内の全ての飲食物に熱が伝達されて所定の温度に達するまでに、時間がかかるのみならず、時間がかかることから、飲食物の持つ風味や食感が損なわれることがある。

【0004】特に、スープやカレールー等の飲食物にあっては、製品化する最終段階で100°C以上に高温度に加熱することが必要となる場合があり、その場合には上述したように、収納容器を介して蒸気等を熱源として被加熱物を加熱すると、被加熱物の内部が所望の温度となるまでには、収納容器に近い部分の温度はその温度よりも高くなるか、あるいは長時間高温状態にさらされることになる。たとえば、収納容器内の被加熱物を热水または蒸気を熱源として容器内の中央部分の被加熱物をも120°C程度にまで加熱するには、120~135°C程度の热水または蒸気を用いる必要があり、周辺部の被加熱物は120°Cを越える温度まで加熱されてしまうことになる。このため、被加熱物は一部が長時間過加熱状態にさらされて食感や風味が損なわれることになる。

【0005】そこで、近年にあっては、上述したような流動性を有する飲食物に直接通電してジュール熱により加熱するようにした加熱技術が開発されつつある。ところで、本発明者は、流動性を有する飲食物をパイプ内に流しながら、被加熱物に対する過加熱の発生を防止するために、ジュール熱を利用して加熱するようにした加熱装置を検討した。

【0006】以下は、本発明者によって検討された技術であり、その概要は次のとおりである。すなわち、飲食物を被加熱物としてこれを管路の中に流すようにし、この管路の中に配置された電極間に通電することにより、被加熱物をジュール熱により加熱するようにした場合には、管路内に配置された電極の部分での被加熱物の流れが円滑とならなかった。このため、電極が破壊されたり、飲食物が電極の部分で詰まったりして、電極部に不具合が発生することがあった。

【0007】また、前述したように流動性を有する飲食物を管路の中を流して加熱する場合には、通電条件を一

定の状態に維持するために、電極間に確実に飲料物が存在する状態のもとで加熱する必要があるので、管の下端部から上端部に向けて飲料物を流すようにしている。

【0008】

【発明が解決しようとする課題】しかしながら、管路の中を上方に向けて流すと、カレールーやビーフシチュー等のように野菜や肉等の固形物を含む流動性の飲食物の場合には、液状の部分のみが上方に向けて流れ、固形物は管路の下端部に残留することがあった。

【0009】このような現象の発生を防止するには、飲食物の流速を高めることが必要となるが、流速を高くすると加熱装置の上下寸法を大きくしなければならず、实用上困難であり、流速を高めないと確実に固形物をも液状部とともに流れるようにする必要がある。

【0010】本発明の目的は流動性を有する飲食物を、風味や食感を損なうことなく、効率良く加熱できるようにすることである。

【0011】本発明の他の目的は、固形物を含む流動性を有する飲食物を、流動性を有する部分と固形部分との混合比を変えることなく、管路内を案内しつつ連続的に加熱できるようにすることである。

【0012】本発明の前記ならびにその他の目的と新規な特徴は、本明細書の記述および添付図面から明らかになるであろう。

【0013】

【課題を解決するための手段】本願において開示される発明のうち、代表的なものの概要を簡単に説明すれば、以下のとおりである。

【0014】すなわち、本発明の加熱装置は、流動性を有する飲食物を管路内に連続的に案内しつつ前記管路内でジュール熱により加熱する加熱装置であって、絶縁性の案内面を有する筒体に前記案内面に対応した案内面を有する環状の電極が設けられた加熱ユニットと、当該加熱ユニットの下端部に接続され当該加熱ユニット内に前記飲食物を供給する流入管路と、前記加熱ユニットによりジュール加熱された飲食物を流出させる流出管路と、前記加熱ユニットを傾斜させて支持する支持部材とを有し、傾斜された状態の加熱ユニット内を飲食物を前記加熱ユニットの下端部から上端部に向けて上昇移動しながら加熱するようにしたことを特徴とする。

【0015】また、本発明の加熱装置は、流動性を有する飲食物を管路内に連続的に案内しつつ前記管路内でジュール熱により加熱する加熱装置であって、絶縁性の案内面を有する筒体に前記案内面に対応した案内面を有する環状の電極が設けられた加熱ユニットと、当該加熱ユニットの下端部に接続され当該加熱ユニット内に前記飲食物を供給する流入管路と、前記加熱ユニットによりジュール加熱された飲食物を流出させる流出管路と、前記加熱ユニットをその上端部または下端部で傾斜角度を調整自在に支持する支持部材とを有し、飲食物の特性に応

じて前記加熱ユニットの傾斜角度を調整し得るようにしたことと特徴とする。

【0016】

【作用】上記構成を有する本発明にあっては、熱伝導により被加熱物が100°C以下の温度に予熱された後に、ジュール熱により被加熱物を直接加熱する加熱ユニットに供給されて、100°C以上に迅速に加熱される。100°C以上の温度での本加熱工程では、ジュール熱により被加熱物が迅速に加熱されることから、被加熱物の風味等を損なうことなく加熱することが可能となる。

【0017】加熱ユニットは傾斜して配置されるので、内部に固形物等が混入された被加熱物であっても、加熱ユニット内を確実に上昇移動させながら、被加熱物を加熱することができる。

【0018】加熱ユニットの傾斜角度は被加熱物の特性に応じて所定の角度に調整することができるので、被加熱物の特性に最適な条件の下で加熱することができる。

【0019】

【実施例】以下、本発明の実施例を図面に基づいて詳細に説明する。図1は本発明の加熱装置の一実施例を示す図であり、図示する加熱装置は、カレールー等のような流動性を有する飲食物からなる被加熱物が投入されるホッパー11を有している。このホッパー11内に投入された被加熱物の残料を検出するために、レベルセンサ12がホッパー11に取り付けられている。

【0020】なお、ホッパー11内の被加熱物内の固形物等を均一に分散させるために、ホッパー11内に図示しない攪拌機を設けるようにしても良い。

【0021】ホッパー11内の被加熱物を送り出すために、ホッパー11の下部にはポンプ13が取り付けられており、このポンプ13によりホッパー11内の被加熱物は供給パイプ14を介して予備加熱用の熱交換器15に供給されるようになっている。なお、ホッパー11を用いることなく、図1に二点鎖線で示すパイプ14aをポンプ13に直接接続して被加熱物を供給するようにしても良い。

【0022】この熱交換器15内には蒸気供給管16から流入して蒸気排出管17から排出される蒸気が循環するようになっており、熱交換器15内には、たとえば100~105°C程度の熱水または蒸気が供給される。被加熱物は熱交換器15を構成する壁部材を介して熱伝導により熱水または蒸気を熱媒体として加熱されることになる。被加熱物の平均温度は90°C程度とし、105°Cを越えることなく、被加熱物である流動性を有する飲食物の風味や食感を損なうことがない。

【0023】熱伝導型の予備加熱工程を構成する熱交換器15を通過した被加熱物は、ポンプ13によって3つの加熱ユニット21, 22, 23に順次供給される。

【0024】加熱ユニット21の詳細構造を示すと図4の通りであり、他の加熱ユニット22, 23もほぼ同様

の構造となっている。

【0025】図4に示すように加熱ユニット21は、両端に接続部24, 25がねじ結合されるようになった筒状補強部材26を有しており、この筒状補強部材26の内部には2対の加熱部27, 28が組み込まれている。一方の加熱部27を示すと、図5の通りである。それぞれの加熱部27, 28は、円筒形状をなし内部に断面円形の案内面31が形成された加熱筒体32と、これの両端部に配置された環状の電極33, 34とから構成されている。

【0026】それぞれの電極33, 34は加熱筒体32の案内面31に対応した案内面35を有しており、2対の加熱部27, 28の間にはスペーサ36が配置され、さらに接続部24, 25と両方の加熱部27, 28との間にはスペーサ37, 38が配置されている。

【0027】前記加熱筒体32およびスペーサ36~38は、テトラフルオロエチレン等の絶縁性のフッ素含有樹脂により形成されており、ポリエーテルエーテルケトン等のような耐熱性および耐圧性に優れた高強度の絶縁材料を用いるようにしても良い。

【0028】電極33, 34はチタン等の耐蝕性の材料により形成されているが、案内面が絶縁性となつていれば良く、電極33, 34の内外周面に耐蝕性の物質を表面処理するようにすれば、種々の材料を用いることが可能となる。また、加熱筒体32やスペーサ36~38を金属により形成し、全表面に絶縁材料を被覆するようにしても良い。さらに、加熱部27, 28により形成される加熱用の管路の内面の断面形状は、図示するように円形に限らず、四角形等の種々の断面形状とすることが可能である。

【0029】筒状補強部材26の内部に組み込まれた加熱筒体32、電極33, 34およびスペーサ36~38相互の間には、パッキン39を介在することにより、被加熱物の漏出が防止されている。

【0030】それぞれの電極33, 34の内部には、冷却水循環用の空洞41が形成されており、冷却水供給管42により全ての電極33, 34に順次冷却水が供給されるようになっている。

【0031】図6は本発明の他の実施例の電極33を示す図であり、空洞41はそれぞれドリルにより形成された3本の孔40a~40cを交差させることにより形成されている。2本の孔40aと40cを連通させるための孔40bには盲栓30により閉塞されている。図6に示す場合には、電極33の両端面に段部33a, 33bが形成されており、それぞれの段部に加熱筒体32の先端とスペーサ37の先端に形成された段部が嵌合するようになっている。

【0032】他方の電極34もほぼ同様の構造となっている。ただし、電極33, 34に空洞41を形成しないようにしても良い。その場合には、加熱筒体32、電極

33, 34等により形成される管路の外周面を冷却することが可能である。

【0033】図1に示すように、熱交換器15は加熱ユニット21に継手43を介して連結され、加熱ユニット21の上端と加熱ユニット22の下端は継手44を介して相互に連結され、さらに、加熱ユニット22の上端は加熱ユニット23に継手45を介して連結されている。

【0034】3段目の加熱ユニット23には、上述した3つの加熱ユニット21～23と同様の構造となった保温用の加熱ユニット48が継手46を介して連結されており、この保温用の加熱ユニット48は、加熱ユニット21～23を通過した被加熱物を冷却するまでの時間と温度を調整するために使用され、ジュール加熱された被加熱物を流出させるための流出管路となっている。この保温用の加熱ユニット48は、水平状態に固定されており、継手47を介して三方弁49に連結されている。ただし、被加熱物の種類によっては、保温用の加熱ユニット48を作動させなくても良い。

【0035】三方弁49には2本の分岐パイプ51, 52が連結されており、一方の分岐パイプ51は回収タンク53の下端部に接続され、他方の分岐パイプ52は製品タンク54の下端部に接続されている。

【0036】回収タンク53は加熱ユニット21～23による被加熱物に対する通電加熱が定常状態となるまでに加熱ユニット21～23を通過した被加熱物を収容してこれを回収するためのタンクである。製品タンク54は加熱ユニット21～23が定常状態となった後の被加熱物を収容するためのタンクである。

【0037】製品タンク54と三方弁49とを連結する分岐パイプ52には、2つの冷却器55a, 55bが設けられている。それぞれの冷却器55a, 55b内には、冷却水供給パイプ56aから流入して、冷却水排出パイプ56bから流出する冷却水が循環し、加熱ユニット21～23および保温用の加熱ユニット48を通過した飲食物が冷却される。

【0038】回収タンク53に飲食物を供給する分岐パイプ51には冷却器が設けられておらず、回収タンク53の外側に冷却水ジャケット57が設けられている。冷却水ジャケット57内には、冷却水供給パイプ58aから冷却水が供給され、冷却水排出パイプ58bから冷却水を流出することにより、冷却水が循環するようになっている。なお、回収タンク53にはこの中に供給された飲料物の量を検出するためのレベルセンサ60aが設けられ、製品タンク54にはこの中に供給された飲料物の量を検出するためのレベルセンサ60bが設けられている。

【0039】供給パイプ14内にホッパー11から吐出された被加熱物の圧力を検出するために、図1に示すように、供給パイプ14には圧力検知器61が設けられている。そして、回収タンク53と製品タンク54内の圧

力を供給パイプ14内の圧力とほぼ同一の圧力に設定するため、コンプレッサや窒素ガスタンク等の気体圧源62とそれぞれのタンク53, 54とに接続された気体圧路63には、圧力調整器64と開閉弁65が設けられている。開閉弁65は圧力検出器61からの信号に基づいて開閉制御部66により作動が制御されるようになっている。

【0040】図3は継手44を詳細に示す図であり、この継手44はそれぞれ90°折り曲げられたエルボ管71, 72を有しており、一方のエルボ管71は加熱ユニット21の上部側の接続部24に嵌合され、他方のエルボ管72は加熱ユニット22の下端部側の接続部25に嵌合されている。

【0041】それぞれのエルボ管71, 72の先端にはフランジ部73が設けられており、ピン74を中心を開閉自在となったクランプ片75, 76を有するクランプ部材77をそれぞれのエルボ管71, 72のフランジ部73に止め付けて、図示しないねじ部材により締結することにより、エルボ管71, 72は相互に連結されるようになっている。

【0042】他の継手もほぼ同様の構造となっており、全ての継手のクランプ部材77を緩めた状態で加熱ユニット21, 22を傾斜移動させることにより、3つの加熱ユニット21～23の相互の傾斜角度を変化させることができる。

【0043】図2は加熱ユニット21～23を傾斜角度を調整自在に支持するための支持部材81を示す図であり、図においては、2つの加熱ユニット21, 22に相当する部分のみが示されている。それぞれの加熱ユニット21, 22の傾斜角度を変化させることができるように、支持部材81に形成された長孔82, 83には、加熱ユニット21, 22に取り付けられた金具84にねじ結合されるねじ部材85が設けられている。

【0044】加熱ユニット21, 22の傾斜角度は、実験によれば、被加熱物の流量と粘度とに応じて設定することが望ましいということが判明した。図7は流量(リットル/分)と粘度(cP)の値に基づいて加熱ユニット21, 22の傾斜角度(水平面とのなす角度)を算出するチャートを示す図であり、流量と粘度とを結んだ線の延長上に交差する値が傾斜角度となる。たとえば、流量が0.5リットルであり、粘度が500cPであれば、傾斜角度は20°となる。

【0045】図8は電極33, 34に供給される電力を制御するための制御回路を示す図であり、電極33の下流側に設けられた温度センサ87からの検出信号は電力調整器88に送られるようになっており、この電力調整器88には電圧設定器89と温度設定器90からの信号が送られるようになっている。これにより、電源91からの電圧および電流が所定の値に電力調整器88により調整されて、電極に供給される。

【0046】電極33、34に供給される電流としては、商用電源としても良く、あるいは高周波電源を供給するよりも良い。また、図示する場合には3つの加熱ユニット21～23を合計すると、6組の電極が設けられているが、何組かを商用電源とし、他の組を高周波電源とするよりも良い。保温用の加熱ユニット48については、保温条件が満たされるように、通電条件が設定される。

【0047】上述した構成を有する加熱装置により被加熱物である流動性を有する飲食物を加熱する場合には、次のような操作がなされる。

【0048】まず、ホッパー11内に被加熱物を投入して、投入された被加熱物をポンプ13により供給パイプ14を介して熱交換器15内に吐出させる。このときには、被加熱物の圧力は大気圧以上の圧力となり、その圧力は圧力検出器61により検出される。

【0049】熱交換器15により蒸気等の熱媒体によって熱伝導により90°C程度に加熱された被加熱物は、順次、加熱ユニット21～23内に流入する。加熱ユニット21内に流入した被加熱物は、電極33、34間に電力を供給することにより、ジュール熱が発生して加熱される。被加熱物自体に発生するジュール熱により加熱すると、熱伝導型の加熱と相違して管路内の中心部分が所要の温度に迅速に上昇し、過加熱の発生が防止される。

【0050】加熱ユニット21内の圧力を大気圧以上の圧力に保持することによって、被加熱物は100°C以上に加熱される。このように、予め熱伝導型の予備加熱を行った後に、ジュール加熱を行うことにより、迅速に100°C以上の所望の温度まで被加熱物を加熱することができ、ジュール加熱を迅速に行うことができる。

【0051】図示する場合には、3つの加熱ユニット21～23が設けられ、それぞれの加熱ユニット21～23には2対の加熱部26、27が組み込まれているので、6段階に分けて温度を上昇させることができる。それぞれの加熱部に対して供給される電力は電力調整器88によって制御される。

【0052】電極33、34に対する電力の供給は、加熱ユニット21～23内に被加熱物が充満された状態で行われることになり、加熱装置を起動させた初期には、被加熱物は所定の温度まで上昇しない。そのため、起動初期の段階における被熱物は、回収タンク53内に案内する。そして、定常状態となった後には、三方弁49を操作することにより、加熱ユニット21～23を通して所定の温度にまで加熱された被加熱物を製品タンク54内に案内する。なお、回収タンク53内の被加熱物は弁67の操作により下方に排出することができる。

【0053】製品タンク54内に被加熱物が流入するに従って、製品タンク54を閉塞状態とすると、この内部の圧力が高くなるが、被加熱物が流入しても、製品タンク54内の圧力が設定圧力に維持されるように、気体圧

路63から圧力調整器64を介して製品タンク54内の空気が外部に排出される。回収タンク53も同様にして所定の圧力となるように制御される。

【0054】製品タンク54内に所定のレベルまで被加熱物が流入したことが、レベルセンサ60bにより検出されたならば、加熱操作を停止して、弁68の操作により下方に排出する。ただし、製品タンク54を2つ配置し、図示しない三方弁の操作により何れか一方の製品タンクに加熱後の被加熱物を案内するようにすれば、連続的に加熱処理を行うことができる。また、分歧パイプ52に二点鎖線で示す製品供給パイプ52aを接続するようにして、冷却後の飲食物を瓶や容器に注入する工程に直接搬送するようにしても良い。

【0055】以上、本発明者によってなされた発明を実施例に基づき具体的に説明したが、本発明は前記実施例に限定されるものではなく、その要旨を逸脱しない範囲で種々変更可能であることはいうまでもない。

【0056】たとえば、図示する場合には3つの加熱ユニット21～23を設けているが、1つの加熱ユニットのみでも良い。また、それぞれの加熱ユニット21～23には、2対の加熱部27、28を組み込むようしているが、1対でもあるいは3対以上でも何れでも良い。さらに、接続部24、25を筒状補強用部材26により締結するようしているが、複数本のロッドを用いて接続部24、25を締結するようにも良い。そして、図4に示すように、それぞれの加熱ユニット21～23内にそれぞれ設けられた4つの電極を冷却するために、これらに順次冷却水を冷却水供給管42により循環するようしているが、それぞれの電極を別々の冷却水供給管により冷却水を供給するようにしても良い。

【0057】予備加熱のために図示する場合には、熱交換器15を使用し、蒸気を熱媒体として被加熱物を予備加熱するようしているが、電熱線を用いたヒータにより加熱するようにしても良い。

#### 【0058】

【発明の効果】本願において開示される発明のうち、代表的なものによって得られる効果を簡単に説明すれば、下記のとおりである。

【0059】(1).熱伝導型の予備加熱とジュール熱を利用した本加熱とを複合させることより、飲食物を必要以上に過加熱することなく短時間で所望の温度まで加熱することができ、飲食物の風味や食感を損なうことなく、迅速に被加熱物を加熱することができる。

【0060】(2).加熱ユニットを傾斜させた状態で加熱ユニットの下端部から被加熱物を流入させるようにしたので、被加熱物の中に含まれる肉や野菜等の固形物をも確実に加熱ユニット内で上昇させることができる。

【0061】(3).加熱ユニットの傾斜角度を調整することができるので、被加熱物の種類や特性に応じて加熱ユニット内を上昇させる際における最適条件を設定するこ

とができる。

【図面の簡単な説明】

【図1】本発明の一実施例の加熱装置を示す概略構成図である。

【図2】図1に示された2つの加熱ユニットを支持するための支持部材を示す正面図である。

【図3】継手を示す斜視図である。

【図4】加熱ユニットを示す断面図である。

【図5】加熱ユニットを構成する加熱部を示す斜視図である。

【図6】(A)は電極の他の実施例を示す断面図、

(B)は同図(A)の側面図である。

【図7】加熱ユニットの傾斜角度を算出するためのチャートを示す図である。

【図8】電極に対して供給される電力を制御する制御回路図である。

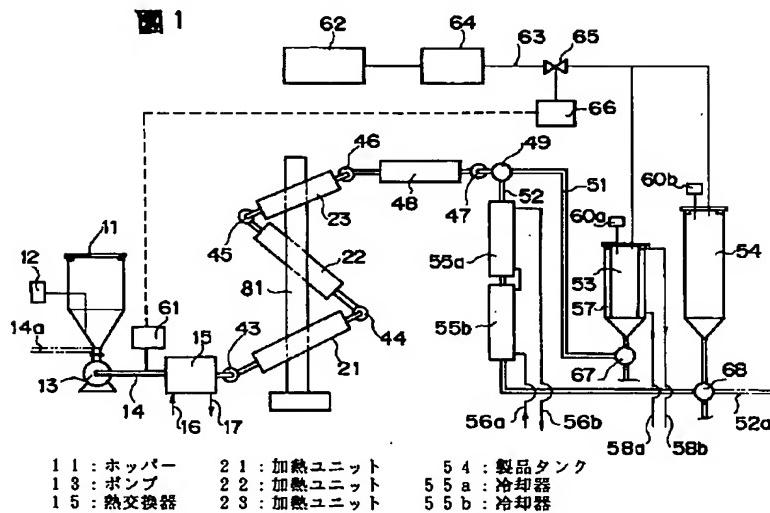
【符号の説明】

- 1 1 ホッパー
- 1 2 レベルセンサ
- 1 3 ポンプ
- 1 4 供給パイプ
- 1 5 热交換器
- 1 6 蒸気供給管
- 1 7 蒸気排出管
- 2 1～2 3 加熱ユニット
- 2 4, 2 5 接続部
- 2 6 筒状補強部材

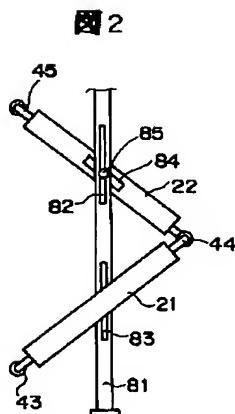
\* 2 7, 2 8 加熱部

- 3 2 加熱筒体
- 3 3, 3 4 電極
- 3 6～3 8 スペーサ
- 3 9 パッキン
- 4 1 空洞
- 4 2 冷却水供給管
- 4 3～4 7 継手
- 4 8 保温用の加熱ユニット
- 10 4 9 三方弁
- 5 1, 5 2 分岐パイプ
- 5 3 回収タンク
- 5 4 製品タンク
- 5 5 a, 5 5 b 冷却器
- 5 7 冷却水ジャケット
- 6 1 圧力検出器
- 6 2 気体圧源
- 6 3 気体圧路
- 6 4 圧力調整器
- 20 6 5 開閉弁
- 7 1, 7 2 エルボ管
- 7 7 クランプ部材
- 8 1 支持部材
- 8 7 温度センサ
- 8 8 電力調整器
- 8 9 電圧設定器
- \* 9 0 温度設定器

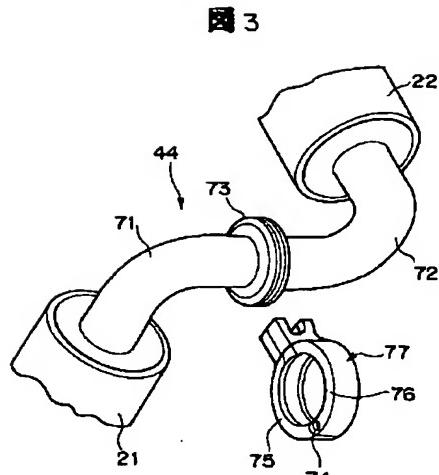
【図1】



【図2】



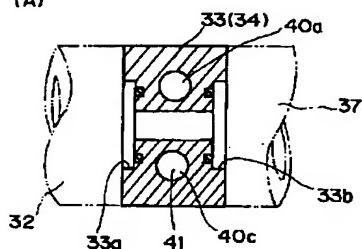
[図3]



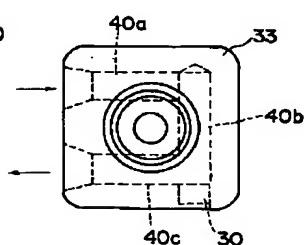
【図6】



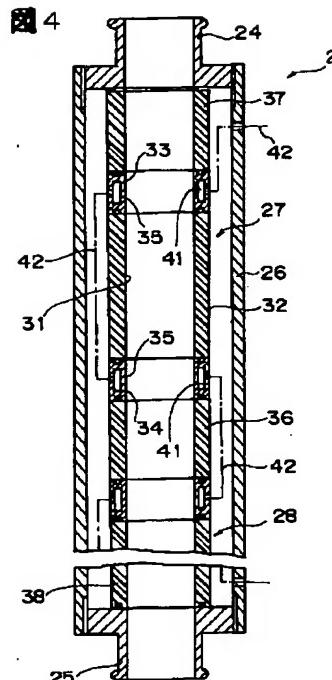
(A)



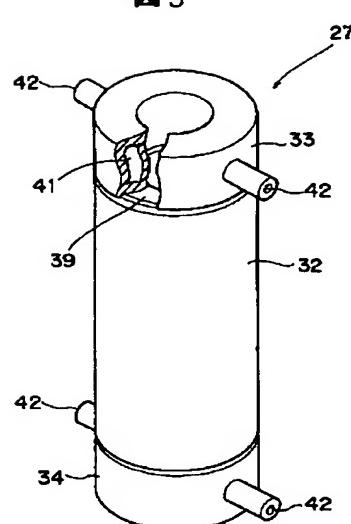
(B)



[図4]



[図5]

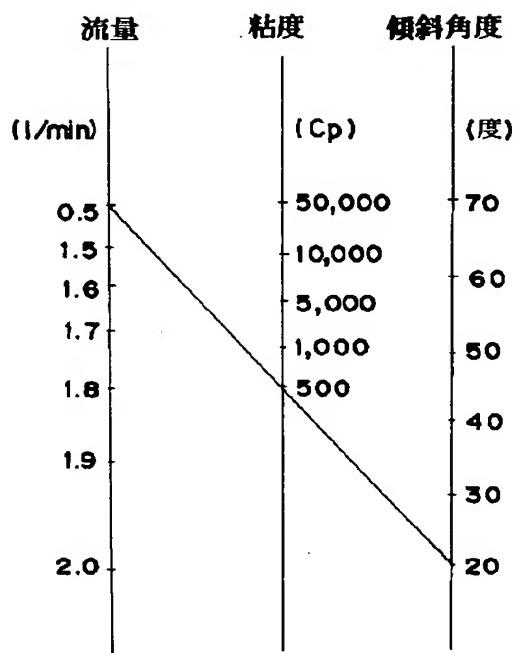


[図8]



【図7】

図7



# PATENT ABSTRACTS OF JAPAN

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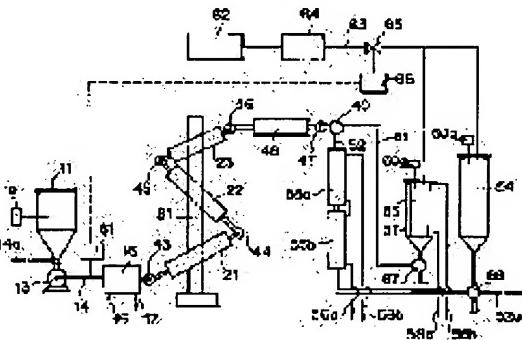
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## **(54) HEATING METHOD AND HEATING APPARATUS**

### **(57)Abstract:**

**PURPOSE:** To heat a fluid food or drink in high efficiency without deteriorating the taste, flavor and palatability of the food, etc.

**CONSTITUTION:** This heating apparatus is provided with heating units 21,22 each composed of a cylinder and at least two electrodes attached to the cylinder interposing a prescribed space. Each heating unit 21,22 is attached to a supporting member 81 in a state inclined at an adjustable inclination angle and a heating object is supplied from the lower end and transferred toward the upper end. The inclination angle is adjusted according to the characteristics of the heating object. Even a heating object containing solid materials mixed therein can be heated under transportation while mixing the solid materials into the object in desired state.



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CLAIMS

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(57) [Claim(s)]

[Claim 1] Heating apparatus characterized by making it heat, having turned ingesta to the upper-limit section from the soffit section of the aforementioned heating unit, and carrying out [had the following,] updrift of the inside of the heating unit in the state where it inclined. The heating unit which is the heating apparatus heated by the Joule's heat within the aforementioned duct, guiding continuously the ingesta which have a fluidity into a duct and by which the annular electrode which has a slideway corresponding to the aforementioned slideway was prepared in the barrel which has an insulating slideway. The inflow duct which is connected to the soffit section of the heating unit concerned, and supplies the aforementioned ingesta in the heating unit concerned. The excurrent canal way into which the ingesta in which the Joule heating was carried out by the aforementioned heating unit are made to flow Supporter material which the aforementioned heating unit is made to incline and is supported [Claim 2] Heating apparatus which is equipped with the following and characterized by enabling it to adjust the degree of tilt angle of the aforementioned heating unit according to the property of ingesta. The heating unit which is the heating apparatus heated by the Joule's heat within the aforementioned duct, guiding continuously the ingesta which have a fluidity into a duct and by which the annular electrode which has a slideway corresponding to the aforementioned slideway was prepared in the barrel which has an insulating slideway. The inflow duct which is connected to the soffit section of the heating unit concerned, and supplies the aforementioned ingesta in the heating unit concerned. The excurrent canal way into which the ingesta in which the Joule heating was carried out by the aforementioned heating unit are made to flow Supporter material which supports the aforementioned heating unit free [adjustment of the degree of tilt angle] in the upper-limit section or the soffit section

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[Translation done.]

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Industrial Application] this invention is used for heating of the viscous high ingesta with which solids, such as ingesta with high viscosity and vegetables, were contained, or the ingesta which makes a principal component the matter which has a fluidity, concerning the technology of heating ingesta, and relates to useful heating technology

#### [0002]

[Description of the Prior Art] Paste-like food, such as liquefied ingesta, such as juice and soup, bean paste, and mustard, In cooking the ingesta which have a liquefied or fluidity like half-solid-like food which contains solids, such as vegetables and meat, still like curry roux and beef stew or heating for sterilization Usually, it is made to heat a stowage container by making a steam, gas, or \*\*\*\* into a heat source, where the ingesta which have these fluidities are held in a stowage container.

[0003] Thus, the flavor and mouthfeel which it not only takes time, but ingesta will have [ time ] from this thing by the time heat is transmitted to all the ingesta in a stowage container and it reaches predetermined temperature, since ingesta, i.e., a heated object, will be heated by heat conduction of itself when heating the ingesta held in the interior of this stowage container through the stowage container by heating a stowage container may be spoiled.

[0004] If it is in ingesta, such as soup and curry roux, especially As it may be necessary for 100 degrees C or more to heat to high temperature and being mentioned above in that case by the culmination to produce commercially If a heated object is heated by making a steam etc. into a heat source through a stowage container, by the time the interior of a heated object will serve as desired temperature, the temperature of the portion near a stowage container becomes higher than the temperature, or will be exposed to an elevated-temperature state for a long time. For example, in order to also heat the heated object for a center section in a container at about 120 degrees C, using hot water or a steam as a heat source for the heated object in a stowage container, it is necessary to use about 120-135-degree C hot water or a steam, and the heated object of a periphery will be heated to the temperature exceeding 120 degrees C. For this reason, a part will be exposed to a fault heating state for a long time, and, as for a heated object, mouthfeel and flavor will be spoiled.

[0005] Then, if it is in recent years, the heating technology which energizes directly to the ingesta which have a fluidity which was mentioned above, and was heated by the Joule's heat is being developed. By the way, this invention person examined the heating apparatus heated using the Joule's heat, in order to prevent generating of fault heating to a heated object, pouring in a pipe the ingesta which have a fluidity.

[0006] The following is the technology examined by this invention person, and the outline is as follows. That is, when a heated object was heated by the Joule's heat by passing this in a duct by using a drink object as a heated object, and energizing to insert electrode [ which has been arranged in this duct ], the flow of the heated object in the portion of the electrode arranged in a duct did not become smooth. For this reason, the electrode might be destroyed, or ingesta might be got blocked with the portion of an electrode, and fault might occur in the polar zone.

[0007] Moreover, since it is necessary to heat by the basis in the state where a drink object certainly exists in inter-electrode in order to maintain energization conditions in the fixed state when passing the inside of a duct and heating the drink object which has a fluidity, as mentioned above, it is made to pour a drink object towards the upper-limit section from the soffit section of a pipe.

#### [0008]

[Problem(s) to be Solved by the Invention] However, when the inside of a duct was turned up and passed, in the case of the fluid ingesta which contain solids, such as vegetables and meat, like curry roux or beef stew, only the liquefied portion might flow towards the upper part, and the solid might remain in the soffit section of a duct.

[0009] It is difficult practically, and it is necessary to also make a solid have to enlarge the vertical size of heating apparatus, if the rate of flow is made high, and flow with the liquefied section certainly, although it is necessary to raise the rate of flow of ingesta in order to prevent generating of such a phenomenon without raising the rate of flow.

[0010] The purpose of this invention is enabling it to heat efficiently the ingesta which have a fluidity, without spoiling flavor and mouthfeel.

[0011] Other purposes of this invention are enabling it to heat continuously, showing the inside of a duct without changing the mixing ratio of the portion and solid portion which have a fluidity for the ingesta which have a fluidity containing a solid.

[0012] The other purposes and the new feature will become clear from description and the accompanying drawing of this specification at the aforementioned row of this invention.

#### [0013]

[Means for Solving the Problem] It will be as follows if the outline of a typical thing is briefly explained among invention indicated in this application.

[0014] Namely, the heating apparatus of this invention is heating apparatus heated by the Joule's heat within the aforementioned duct, guiding continuously the ingesta which have a fluidity into a duct. The heating unit by which the annular electrode which has a slideway corresponding to the aforementioned slideway was prepared in the barrel which has an insulating slideway, The inflow duct which is connected to the soffit section of the heating unit concerned, and supplies the aforementioned ingesta in the heating unit concerned, The excurrent canal way into which the ingesta in which the Joule heating was carried out by the aforementioned heating unit are made to flow, It is characterized by making it heat, having turned ingesta to the upper-limit section from the soffit section of the aforementioned heating unit, and carrying out [ had the support ]

material which the aforementioned heating unit is made to incline and is supported, ] updrift of th inside of the h ating unit in the state wher it inclined.

[0015] Moreover, the heating apparatus of this invention is heating apparatus heated by th Joule's heat within th aforementioned duct, guiding continuously th ingesta which hav a fluidity into a duct. Th h ating unit by which th annular electrode which has a slideway corresponding to th aforementioned slideway was pr pared in the barrel which has an insulating slid way. The inflow duct which is connected to the soffit section of th h ating unit concerned, and supplies th aforementioned ing sta in th heating unit concerned. Th xcurrent canal way into which the ingesta in which the Joul heating was carried out by the aforementioned h ating unit are mad to flow, It has th supporter material which supports th afor mentioned heating unit free [ adjustment of the degree of tilt angl ] in th upper-limit section or th soffit section, and is characterized by enabling it to adjust the degree of tilt angl of th aforementioned heating unit according to th property of ingesta.

[0016]

[Function] If it was in this invention which has the above-mentioned composition, after the temperature of 100 degr es C or less preheats a heated object by heat conduction, the heating unit which heats a heated object directly by the Joule's heat is supplied, and it is quickly heated by 100 degrees C or more. At this heating process with a temperature of 100 degr es C or mor , since a heated object is quickly heated by the Joule's heat, it becomes possible to heat without spoiling the flavor of a heated object etc.

[0017] A heated object can be heated carrying out updrift of the inside of a heating unit certainly, even if it is the heated object with which the solid etc. was mixed in the interior, since a heating unit inclines and is arranged.

[0018] Since the degree of tilt angle of a heating unit can be adjusted to a predetermined angle according to the property of a heated object, it can heat under the optimal conditions for the property of a heated object.

[0019]

[Example] Hereafter, the example of this invention is explained in detail based on a drawing. Drawing 1 is drawing showing one example of the heating apparatus of this invention, and the heating apparatus to illustrate has the hopper 11 with which the heated object which consists of ingesta which have the fluidity of curry roux etc. is thrown in. In order to detect \*\*\*\* of the heated object thrown in in this hopper 11, the level sensor 12 is attached in the hopper 11.

[0020] In addition, in order to distribute uniformly the solid in the heated object in a hopper 11 etc., you may make it form the agitator which is not illustrated in a hopper 11.

[0021] In order to send out the heated object in a hopper 11, the pump 13 is attached in the lower part of a hopper 11, and the heated object in a hopper 11 is supplied to the heat exchanger 15 for preheating through a delivery pipe 14 with this pump 13. In addition, without using a hopper 11, the direct file of the pipe 14a shown in drawing 1 with a two-dot chain line is carri d out to a pump 13, and you may make it supply a heated object.

[0022] The steam which flows from the steamy supply pipe 16 in this heat exchanger 15, and is discharged from th steamy exhaust pipe 17 circulates, and about 100-105-degree C hot water or a steam is supplied in a heat exchanger 15. A heated object will be heated considering hot water or a steam as a heat carrier by heat conduction through the wall material which constitutes a heat exchanger 15. The mean temperature of a heated object does not spoil the flavor or mouthfeel of ingesta which have the fluidity which is a heated object, without considering as about 90 degrees C and exceeding 105 degrees C.

[0023] The heated object which passed the heat exchanger 15 which constitutes the preheating process of a heat conduction type is supplied to three heating units 21, 22, and 23 one by one with a pump 13.

[0024] If the detailed structure of the heating unit 21 is shown, it is as drawing 4 and other heating units 22 and 23 have almost same structure.

[0025] the tubed reinforcement which connections 24 and 25 \*\*\*\* the heating unit 21 to ends, and came to be combined as shown in drawing 4 — a member 26 — having — \*\*\*\* — this tubed reinforcement — two pairs of heating units 27 and 28 are included in the interior of a member 26 When one heating unit 27 is shown, it is as drawing 5 . Each heating unit 27 and 28 consists of a heating cylinder object 32 with which the slideway 31 of a cross-section round shape was formed in the interior of nothing, and annular electrodes 33 and 34 arranged to the both ends of this in the shape of a cylindrical shape.

[0026] Each electrode 33 and 34 has the slideway 35 corresponding to the slideway 31 of the heating cylinder object 32, a spacer 36 is arranged among two pairs of heating units 27 and 28, and spacers 37 and 38 are further arranged betw n connections 24 and 25 and both heating units 27 and 28.

[0027] The aforementioned heating cylinder object 32 and spacers 36-38 are formed with insulating fluorine content r sins, such as a tetrafluoroethylene, and you may make it the insulating material of the high intensity excellent in thermal resistance and pressure resistance, such as a polyether ether ketone, used for them.

[0028] Although electrodes 33 and 34 are formed of corrosion-resistant material, such as titanium, a slideway will become that what is necessary is just insulation possible [ using various material ], if it is made to carry out surface treatment of the corrosion-resistant matter to the inside-and-outside peripheral surface of electrodes 33 and 34. Moreover, the heating cylinder object 32 and spacers 36-38 are formed with a metal, and you may make it cover an insulating material on all front fac s. Furthermore, it does not restrict circularly so that it may illustrate, but the cross-section configuration of the insid of the duct for heating formed of heating units 27 and 28 can be considered as various cross-section configurations, such as a square.

[0029] tubed reinforcement — between the heating cylinder object 32 built into the interior of a member 26, electrodes 33 and 34 and a spacer 36 — both 38, exsorption of a heated object is prevented by intervening packing 39

[0030] The cavity 41 for cooling water flows is form d in th interior of each lectrode 33 and 34, and cooling wat r is supplied to all the electrod s 33 and 34 one by one by the cooling water supply pip 42.

[0031] Drawing 6 is drawing showing the electrode 33 of other examples of this invention, and the cavity 41 is form d by making thre hol s 40a-40c formed by the drill, respectiv ly cross. It is blockaded by the plug 30 by hole 40b for making two holes 40a and 40c open for fre passag . Wh n shown in drawing 6 , St ps 33a and 33b are formed in th ends side of an electrode 33, and th step formed at the nos of cam of th heating cylinder object 32 and the nose of cam of a spacer 37 at each step fits in.

[0032] The electrod 34 of another side also has almost same structur . How ver, you may make it not form a cavity 41 in lectrodes 33 and 34. In this case, it is possibl to cool the peripheral face of the duct formed of the heating cylind r object 32, an electrode 33, and 34 grad s.

[0033] As shown in drawing 1 , a h at xchanger 15 is conn cted with the heating unit 21 through a joint 43, the upper limit of

the heating unit 21 and the soffit of the heating unit 22 are mutually connected through a joint 44, and the upper limit of the heating unit 22 is further connected with the heating unit 23 through the joint 45.

[0034] The heating unit 48 for keeping warm uses the same structure as three heating units 21-23 mentioned above is connected with heating [ the 3rd step of ] unit 23 through the joint 46. The heating unit 48 for this keeping warm serves as an exhaust canal way for being used in order to adjust time and temperature until it cools the heated object which passed the heating units 21-23, and making the heated object by which the Joule heating was carried out flow out. It is fixed to the level stat and the heating unit 48 for this keeping warm is connected with the cross valve 49 through the joint 47. However, it is not necessary to operate the heating unit 48 for keeping warm depending on the kind of heated object.

[0035] Two branching pipes 51 and 52 are connected with the cross valve 49, one branching pipe 51 is connected to the soffit section of the recovery tank 53, and the branching pipe 52 of another side is connected to the soffit section of the product tank 54.

[0036] The recovery tank 53 is a tank for holding the heated object which passed the heating units 21-23 by the time energization heating to the heated object by the heating units 21-23 would be in the steady state, and collecting these. The product tank 54 is a tank for holding the heated object after the heating units 21-23 will be in a steady state.

[0037] Two condensators 55a and 55b are formed in the branching pipe 52 which connects the product tank 54 and a cross valve 49. In each condensator 55a and 55b, it flows from cooling water delivery pipe 56a, the cooling water which flows out of cooling water eccentric pipe 56b circulates, and the ingesta which passed the heating units 21-23 and the heating unit 48 for keeping warm are cooled.

[0038] A condensator is not formed in the branching pipe 51 which supplies ingesta to the recovery tank 53, but the cooling water jacket 57 is formed in the outside of the recovery tank 53. In a cooling water jacket 57, cooling water is supplied from cooling water delivery pipe 58a, and cooling water circulates by flowing cooling water out of cooling water eccentric pipe 58b. In addition, level sensor 60a for detecting the amount of the drink object supplied into this on the recovery tank 53 is prepared, and level sensor 60b for detecting the amount of the drink object supplied into this is prepared in the product tank 54.

[0039] In order to detect the pressure of the heated object breathed out from the hopper 11 in the delivery pipe 14, as shown in drawing 1, the pressure detector 61 is formed in the delivery pipe 14. And in order to set the pressure in the recovery tank 53 and the product tank 54 as the almost same pressure as the pressure in a delivery pipe 14, the pressure regulator 64 and the opening-and-closing valve 65 are formed in the gas pressure way 63 connected to the source 62 of gas pressure and each tank 53 and 54, such as a compressor and a nitrogen gas holder. Based on the signal from a pressure sensor 61, as for the opening-and-closing valve 65, an operation is controlled by the opening-and-closing control section 66.

[0040] Drawing 3 is drawing showing a joint 44 in detail, this joint 44 has the elbow pipes 71 and 72 bent 90 degrees, respectively, one elbow pipe 71 fitted into the connection 24 by the side of the upper part of the heating unit 21, and the elbow pipe 72 of another side has fitted into the connection 25 by the side of the soffit section of the heating unit 22.

[0041] the clamp which has the pieces 75 and 76 of a clamp whose opening and closing the flange 73 is formed at the nose of cam of each elbow pipe 71 and 72, and were attained centering on the pin 74 — stop a member 77 to the flange 73 of each elbow pipe 71 and 72 — the elbow pipes 71 and 72 are mutually connected by [ which do not attach and illustrate ] \*\*\*ing and concluding by the member

[0042] the structure where other joints are almost the same — becoming — \*\*\* — the clamp of all joints — the mutual degree of tilt angle of three heating units 21-23 can be changed by carrying out the dip slip of the heating units 21 and 22, where a member 77 is loosened

[0043] Drawing 2 is drawing showing the supporter material 81 for supporting the heating units 21-23 free [ adjustment of the degree of tilt angle ], and only the portion equivalent to two heating units 21 and 22 is shown in drawing. The thread-part material 85 which \*\*\*s to the metallic ornaments 84 attached in the heating units 21 and 22, and is combined with them is formed in the long holes 82 and 83 formed in the supporter material 81 so that the degree of tilt angle of each heating unit 21 and 22 can be changed.

[0044] According to the experiment, that it is desirable setting up according to the flow rate and viscosity of a heated object made clear the degree of tilt angle of the heating units 21 and 22. Drawing 7 is drawing showing the chart which computes the degree of tilt angle of the heating units 21 and 22 (angle with the level surface to make) based on the value of a flow rate (a part for liter/), and viscosity (cp), and the value which crosses on extension of the line which connected a flow rate and viscosity serves as the degree of tilt angle. For example, a flow rate is 0.5l., and if viscosity is 500cp(s), the degree of tilt angle will become 20 degrees.

[0045] Drawing 8 is drawing showing the control circuit for controlling the power supplied to electrodes 33 and 34, the detecting signal from the temperature sensor 87 prepared in the downstream of an electrode 33 is sent to a power conditioner 88, and the signal from the voltage setter 89 and the temperature setter 90 is sent to this power conditioner 88. Thereby, the voltage and current from a power supply 91 are adjusted to a predetermined value by the power conditioner 88, and are supplied to an electrode.

[0046] It is good also as a source power supply, or you may make it supply a RF generator as current supplied to electrodes 33 and 34. Moreover, if it totals three heating units 21-23 in illustrating, although 6 sets of electrodes are prepared, several sets are made into a source power supply, and be made to let other groups be RF generators. About the heating unit 48 for keeping warm, energization conditions are set up so that keeping-warm conditions may be fulfilled.

[0047] The following operations are made when heating the ingesta which have the fluidity which is a heated object with the heating apparatus which has the composition mentioned above.

[0048] First, a heated object is thrown in in a hopper 11 and the thrown-in heated object is made to breathe out in a heat exchanger 15 through a delivery pipe 14 with a pump 13. At this time, the pressure of a heated object turns into a pressure more than atmospheric pressure, and the pressure is detected by the pressure sensor 61.

[0049] The heated object heated by heat carriers, such as a steam, by heat conduction at about 90 degrees C flows in the heating unit 21-23 one by one with a heat exchanger 15. By supplying power between an electrode 33 and 34, the Joule's heat occurs and the heated object which flowed in the heating unit 21 is heated. If it heats by the Joule's heat generated in the heated object itself, it will be different from heating of a heat conduction type, the amount of [ in a duct ] core will go up quickly to necessary temperature, and generating of fault heating will be prevented.

[0050] A heated object is heated by 100 degrees C or more by holding the pressure in the heating unit 21 to the pressure more than atmospheric pressure. Thus, after performing preheating of a heat conduction type beforehand, by performing the Joule

heating, a heated object can be quickly heated to the temperature of a request of 100 degrees C or more, and the Joule heating can be performed quickly.

[0051] Since three heating units 21-23 are formed and two pairs of heating units 26 and 27 are included in each heating unit 21-23 when illustrating, it can divide into six stages and the temperature can be raised. The power supplied to each heating unit is controlled by the power conditioner 88.

[0052] Supply of power to electrodes 33 and 34 will be performed after the heated object has been full in the heating unit 21-23, and a heated object does not go up to predetermined temperature in the first stage which started heating apparatus. Therefore, \*\*\*\*-ed in the stage in early stages of starting is guided into the recovery tank 53. And after being in a steady state, the heated object which passed the heating units 21-23 and was heated by even predetermined temperature is guided into the product tank 54 by operating a cross valve 49. In addition, the heated object in the recovery tank 53 can be caused to be discharged by operation of a valve 67.

[0053] Although the pressure of this interior will become high if the product tank 54 is made into a lock out state as a heated object flows in the product tank 54, even if a heated object flows, the air in the product tank 54 is discharged outside through a pressure regulator 64 from the gas pressure way 63 so that the pressure in the product tank 54 may be maintained by the setting pressure. It is controlled so that the recovery tank 53 serves as a predetermined pressure similarly.

[0054] If it is detected by level sensor 60b that the heated object flowed to predetermined level in the product tank 54, it will suspend heating operation and will discharge caudad by operation of a valve 68. However, two product tanks 54 are arranged, and if the heated object after heating on one of product tanks is guided by operation of the cross valve which is not illustrated, it can heat-treat continuously. Moreover, as product delivery pipe 52a shown in the branching pipe 52 with a two-dot chain line is connected, you may make it convey directly at the process which pours the ingesta after cooling into a bottle or a container.

[0055] As mentioned above, although invention made by this invention person was concretely explained based on the example, it cannot be overemphasized by this invention that it can change variously in the range which is not limited to the aforementioned example and does not deviate from the summary.

[0056] For example, although it has formed three heating units 21-23 in illustrating, only one heating unit is. Moreover, although it is made to include two pairs of heating units 27 and 28 in each heating unit 21-23, three or more pairs or any is sufficient as at least one pair. Furthermore, although it is made to conclude connections 24 and 25 by the member 26 for tubed reinforcement, you may make it conclude connections 24 and 25 using two or more rods. And although it is made to circulate through cooling water with the cooling water supply pipe 42 one by one to these in order to cool four electrodes prepared in each heating unit 21-23, respectively, as shown in drawing 4, you may make it supply cooling water for each electrode with a separate cooling water supply pipe.

[0057] Although a heat exchanger 15 is used and it is made to carry out preheating of the heated object by using a steam as a heat carrier in illustrating for preheating, you may make it heat at the heater using heating wire.

[0058]

[Effect of the Invention] It will be as follows if the effect acquired by the typical thing among invention indicated in this application is explained briefly.

[0059] (1) From compounding the preheating of . heat conduction type, and this heating using the Joule's heat, it can heat to desired temperature in a short time, without carrying out fault heating of the ingesta more than required, and a heated object can be heated quickly, without spoiling the flavor and mouthfeel of ingesta.

[0060] (2) Since it was made to make a heated object flow from the soffit section of a heating unit in the state where . heating unit was made to incline, solids contained in a heated object, such as meat and vegetables, can also be certainly raised within a heating unit.

[0061] (3) Since the degree of tilt angle of . heating unit can be adjusted, the optimum conditions at the time of raising the inside of a heating unit according to the kind and property of a heated object can be set up.

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[Translation done.]

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PRIOR ART

[Description of the Prior Art] They are curry roux, beef stew, etc. to paste-like food, such as liquefied ingesta, such as juice and soup, bean paste, and mustard, and a pan. In cooking the ingesta which have a liquefied or fluidity containing solids, such as vegetables and meat, like half-solid-like food or heating for sterilization, it is making it heat a stowage container by making a steam, gas, or \*\*\*\* into a heat source, where the ingesta which have these fluidities are usually held in a stowage container. [0003] Thus, when heating the ingesta held in the interior of this stowage container through the stowage container by heating a stowage container, it is. The flavor and mouthfeel which it not only takes time, but ingesta will have [ time ] from this thing by the time heat is transmitted to all the ingesta in a stowage container and it reaches predetermined temperature, since ingesta, i.e., a heated object, will be heated by heat conduction of itself may be spoiled.

[0004] If it is in ingesta, such as soup and curry roux, especially If a heated object is heated by making a steam etc. into a heat source through a stowage container as it may be necessary for 100 degrees C or more to heat to high temperature and being mentioned above in that case by the culmination to produce commercially, by the time the interior of a heated object will serve as desired temperature, the temperature of the portion near a stowage container becomes higher than the temperature, or will be exposed to an elevated-temperature state for a long time. For example, in order to also heat the heated object for a center section in a container at about 120 degrees C, using hot water or a steam as a heat source for the heated object in a stowage container, it is necessary to use about 120-135-degree C hot water or a steam, and the heated object of a periphery will be heated to the temperature exceeding 120 degrees C. For this reason, a part will be exposed to a fault heating state for a long time, and, as for a heated object, mouthfeel and flavor will be spoiled.

[0005] Then, if it is in recent years, the heating technology which energizes directly to the ingesta which have a fluidity which was mentioned above, and was heated by the Joule's heat is being developed. By the way, this invention person examined the heating apparatus heated using the Joule's heat, in order to prevent generating of fault heating to a heated object, pouring in a pipe the ingesta which have a fluidity.

[0006] The following is the technology examined by this invention person, and the outline is as follows. That is, when a heated object was heated by the Joule's heat by passing this in a duct by using a drink object as a heated object, and energizing to inter-electrode [ which has been arranged in this duct ], the flow of the heated object in the portion of the electrode arranged in a duct did not become smooth. For this reason, the electrode might be destroyed, or ingesta might be got blocked with the portion of an electrode, and fault might occur in the polar zone.

[0007] Moreover, since it is necessary to heat by the basis in the state where a drink object certainly exists in inter-electrode in order to maintain energization conditions in the fixed state when passing the inside of a duct and heating the drink object which has a fluidity, as mentioned above, it is made to pour a drink object towards the upper-limit section from the soffit section of a pipe.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] It will be as follows if the effect acquired by the typical thing among invention indicated in this application is explained briefly.

[0059] (1) From compounding the preheating of . heat conduction type, and this heating using the Joule's heat, it can heat to desired temperature in a short time, without carrying out fault heating of the ingesta more than required, and a heated object can be heated quickly, without spoiling the flavor and the feeling of a meal of ingesta.

[0060] (2) Since it was made to make a heated object flow from the soffit section of a heating unit in the state where . heating unit was made to incline, solids contained in a heated object, such as meat and vegetables, can also be certainly raised within a heating unit.

[0061] (3) Since the degree of tilt angle of . heating unit can be adjusted, the optimum conditions at the time of raising the inside of a heating unit according to the kind and property of a heated object can be set up.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, when the inside of a duct was turned up and passed, in the case of the fluid ingesta which contain solids, such as vegetables and meat, like curry roux or beef stew, only the liquefied portion might flow towards the upper part, and the solid might remain in the soffit section of a duct.

[0009] It is difficult practically, and it is necessary to also make a solid have to enlarge the vertical size of heating apparatus, if the rate of flow is made high, and flow with the liquefied section certainly, although it is necessary to raise the rate of flow of ingesta in order to prevent generating of such a phenomenon without raising the rate of flow.

[0010] The purpose of this invention is enabling it to heat efficiently the ingesta which have a fluidity, without spoiling flavor and a feeling of a meal.

[0011] Other purposes of this invention are enabling it to heat continuously, showing the inside of a duct without changing the mixing ratio of the portion and solid portion which have a fluidity for the ingesta which have a fluidity containing a solid.

[0012] The other purposes and the new feature will become clear from description and the accompanying drawing of this specification at the aforementioned row of this invention.

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MEANS

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[Means for Solving the Problem] It will be as follows if the outline of a typical thing is briefly explained among invention indicated in this application.

[0014] Namely, the heating apparatus of this invention is heating apparatus heated by the Joule's heat within the aforementioned duct, guiding continuously the ingesta which have a fluidity into a duct. The heating unit by which the annular electrode which has a slideway corresponding to the aforementioned slideway was prepared in the barrel which has an insulating slideway, The inflow duct which is connected to the soffit section of the heating unit concerned, and supplies the aforementioned ingesta in the heating unit concerned, The excurrent canal way into which the ingesta in which the Joule heating was carried out by the aforementioned heating unit are made to flow, It is characterized by making it heat, having turned ingesta to the upper-limit section from the soffit section of the aforementioned heating unit, and carrying out [ had the supporter material which the aforementioned heating unit is made to incline and is supported, ] updrift of the inside of the heating unit in the state where it inclined.

[0015] Moreover, the heating apparatus of this invention is heating apparatus heated by the Joule's heat within the aforementioned duct, guiding continuously the ingesta which have a fluidity into a duct. The heating unit by which the annular electrode which has a slideway corresponding to the aforementioned slideway was prepared in the barrel which has an insulating slideway, The inflow duct which is connected to the soffit section of the heating unit concerned, and supplies the aforementioned ingesta in the heating unit concerned, The excurrent canal way into which the ingesta in which the Joule heating was carried out by the aforementioned heating unit are made to flow, It has the supporter material which supports the aforementioned heating unit free [ adjustment of the degree of tilt angle ] in the upper-limit section or the soffit section, and is characterized by enabling it to adjust the degree of tilt angle of the aforementioned heating unit according to the property of ingesta.

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## OPERATION

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[Function] If it was in this invention which has the above-mentioned composition, after the temperature of 100 degrees C or less preheats a heated object by heat conduction, the heating unit which heats a heated object directly by the Joule's heat is supplied, and it is quickly heated by 100 degrees C or more. At this heating process with a temperature of 100 degrees C or more, since a heated object is quickly heated by the Joule's heat, it becomes possible to heat without spoiling the flavor of a heated object etc.

[0017] A heated object can be heated carrying out updrift of the inside of a heating unit certainly, even if it is the heated object with which the solid etc. was mixed in the interior, since a heating unit inclines and is arranged.

[0018] Since the degree of tilt angle of a heating unit can be adjusted to a predetermined angle according to the property of a heated object, it can heat under the optimal conditions for the property of a heated object.

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## EXAMPLE

[Example] Hereafter, the example of this invention is explained in detail based on a drawing. Drawing 1 is drawing showing one example of the heating apparatus of this invention, and the heating apparatus to illustrate has the hopper 11 with which the heated object which consists of ingesta which have the fluidity of curry roux etc. is thrown in. In order to detect \*\*\*\* of the heated object thrown in in this hopper 11, the level sensor 12 is attached in the hopper 11.

[0020] In addition, in order to distribute uniformly the solid in the heated object in a hopper 11 etc., you may make it form the agitator which is not illustrated in a hopper 11.

[0021] In order to send out the heated object in a hopper 11, the pump 13 is attached in the lower part of a hopper 11, and the heated object in a hopper 11 is supplied to the heat exchanger 15 for preheating through a delivery pipe 14 with this pump 13. In addition, without using a hopper 11, the direct file of the pipe 14a shown in drawing 1 with a two-dot chain line is carried out to a pump 13, and you may make it supply a heated object.

[0022] The steam which flows from the steamy supply pipe 16 in this heat exchanger 15, and is discharged from the steamy exhaust pipe 17 circulates, and about 100–105-degree C hot water or a steam is supplied in a heat exchanger 15. A heated object will be heated considering hot water or a steam as a heat carrier by heat conduction through the wall material which constitutes a heat exchanger 15. The mean temperature of a heated object does not spoil the flavor or mouthfeel of ingesta which have the fluidity which is a heated object, without considering as about 90 degrees C and exceeding 105 degrees C.

[0023] The heated object which passed the heat exchanger 15 which constitutes the preheating process of a heat conduction type is supplied to three heating units 21, 22, and 23 one by one with a pump 13.

[0024] If the detailed structure of the heating unit 21 is shown, it is as drawing 4 and other heating units 22 and 23 have almost same structure.

[0025] The tubed reinforcement which connects 24 and 25 \*\*\*\* the heating unit 21 to ends, and came to be combined as shown in drawing 4 — a member 26 — having — \*\*\*\* — this tubed reinforcement — two pairs of heating units 27 and 28 are included in the interior of a member 26. When one heating unit 27 is shown, it is as drawing 5. Each heating unit 27 and 28 consists of a heating cylinder object 32 with which the slideway 31 of a cross-section round shape was formed in the interior of nothing, and annular electrodes 33 and 34 arranged to the both ends of this in the shape of a cylindrical shape.

[0026] Each electrode 33 and 34 has the slideway 35 corresponding to the slideway 31 of the heating cylinder object 32, a spacer 36 is arranged among two pairs of heating units 27 and 28, and spacers 37 and 38 are further arranged between connections 24 and 25 and both heating units 27 and 28.

[0027] The aforementioned heating cylinder object 32 and spacers 36–38 are formed with insulating fluorine content resins, such as a tetrafluoroethylene, and you may make it the insulating material of the high intensity excellent in thermal resistance and pressure resistance, such as a polyether ether ketone, used for them.

[0028] Although electrodes 33 and 34 are formed of corrosion-resistant material, such as titanium, a slideway will become that what is necessary is just insulation possible [ using various material ], if it is made to carry out surface treatment of the corrosion-resistant matter to the inside-and-outside peripheral surface of electrodes 33 and 34. Moreover, the heating cylinder object 32 and spacers 36–38 are formed with a metal, and you may make it cover an insulating material on all front faces. Furthermore, it does not restrict circularly so that it may illustrate, but the cross-section configuration of the inside of the duct for heating formed of heating units 27 and 28 can be considered as various cross-section configurations, such as a square.

[0029] tubed reinforcement — between the heating cylinder object 32 built into the interior of a member 26, electrodes 33 and 34 and a spacer 36 — both 38, exsorption of a heated object is prevented by intervening packing 39

[0030] The cavity 41 for cooling water flows is formed in the interior of each electrode 33 and 34, and cooling water is supplied to all the electrodes 33 and 34 one by one by the cooling water supply pipe 42.

[0031] Drawing 6 is drawing showing the electrode 33 of other examples of this invention, and the cavity 41 is formed by making three holes 40a–40c formed by the drill, respectively cross. It is blockaded by the plug 30 by hole 40b for making two holes 40a and 40c open for free passage. When shown in drawing 6, Steps 33a and 33b are formed in the ends side of an electrode 33, and the step formed at the nose of cam of the heating cylinder object 32 and the nose of cam of a spacer 37 at each step fits in.

[0032] The electrode 34 of another side also has almost same structure. However, you may make it not form a cavity 41 in electrodes 33 and 34. In this case, it is possible to cool the peripheral face of the duct formed of the heating cylinder object 32, an electrode 33, and 34 grades.

[0033] As shown in drawing 1, a heat exchanger 15 is connected with the heating unit 21 through a joint 43, the upper limit of the heating unit 21 and the soffit of the heating unit 22 are mutually connected through a joint 44, and the upper limit of the heating unit 22 is further connected with the heating unit 23 through a joint 45.

[0034] The heating unit 48 for keeping warm used as the same structure as the heating units 21–23 mentioned above is connected with heating [ the 3rd step of ] unit 23 through the joint 46. The heating unit 48 for this keeping warm serves as an exhaust canal way for being used in order to adjust time and temperature until it cools the heated object which passed the heating units 21–23, and making the heated object by which the Joule heating was carried out flow out. It is fixed to the level state and the heating unit 48 for this keeping warm is connected with the cross valve 49 through the joint 47. However, it is not necessary to operate the heating unit 48 for keeping warm depending on the kind of heated object.

[0035] Two branching pipes 51 and 52 are connected with the cross valve 49, on branching pipe 51 is connected to the soffit section of the recovery tank 53, and the branching pipe 52 of another side is connected to the soffit section of the product tank

54.

[0036] The recovery tank 53 is a tank for holding the heated object which passed the heating units 21–23 by the time energization heating to the heated object by the heating units 21–23 would be in the steady state, and collecting the heated product tank 54 is a tank for holding the heated object after the heating units 21–23 will be in a steady state.

[0037] Two condensators 55a and 55b are formed in the branching pipe 52 which connects the product tank 54 and a cross valve 49. In each condensator 55a and 55b, it flows from cooling water delivery pipe 56a, the cooling water which flows out of cooling water discharge pipe 56b circulates, and the ingesta which passed the heating units 21–23 and the heating unit 48 for keeping warm are cooled.

[0038] A condensator is not formed in the branching pipe 51 which supplies ingesta to the recovery tank 53, but the cooling water jacket 57 is formed in the outside of the recovery tank 53. In a cooling water jacket 57, cooling water is supplied from cooling water delivery pipe 58a, and cooling water circulates by flowing cooling water out of cooling water discharge pipe 58b. In addition, level sensor 60a for detecting the amount of the drink object supplied into this on the recovery tank 53 is prepared, and level sensor 60b for detecting the amount of the drink object supplied into this is prepared in the product tank 54.

[0039] In order to detect the pressure of the heated object breathed out from the hopper 11 in the delivery pipe 14, as shown in drawing 1, the pressure detector 61 is formed in the delivery pipe 14. And in order to set the pressure in the recovery tank 53 and the product tank 54 as the almost same pressure as the pressure in a delivery pipe 14, the pressure regulator 64 and the opening-and-closing valve 65 are formed in the gas pressure way 63 connected to the source 62 of gas pressure and each tank 53 and 54, such as a compressor and a nitrogen gas holder. Based on the signal from a pressure sensor 61, as for the opening-and-closing valve 65, an operation is controlled by the opening-and-closing control section 66.

[0040] Drawing 3 is drawing showing a joint 44 in detail, this joint 44 has the elbow pipes 71 and 72 bent 90 degrees, respectively, one elbow pipe 71 fitted into the connection 24 by the side of the upper part of the heating unit 21, and the elbow pipe 72 of another side has fitted into the connection 25 by the side of the soffit section of the heating unit 22.

[0041] the clamp which has the pieces 75 and 76 of a clamp whose opening and closing the flange 73 is formed at the nose of cam of each elbow pipe 71 and 72, and were attained centering on the pin 74 — stop a member 77 to the flange 73 of each elbow pipe 71 and 72 — the elbow pipes 71 and 72 are mutually connected by [ which do not attach and illustrate ] \*\*\*king and concluding by the member

[0042] the structure where other joints are almost the same — becoming — \*\*\* — the clamp of all joints — the mutual degree of tilt angle of three heating units 21–23 can be changed by carrying out the dip slip of the heating units 21 and 22, where a member 77 is loosened

[0043] Drawing 2 is drawing showing the supporter material 81 for supporting the heating units 21–23 free [ adjustment of the degree of tilt angle ], and only the portion equivalent to two heating units 21 and 22 is shown in drawing. The thread-part material 85 which \*\*\*s to the metallic ornaments 84 attached in the heating units 21 and 22, and is combined with them is formed in the long holes 82 and 83 formed in the supporter material 81 so that the degree of tilt angle of each heating unit 21 and 22 can be changed.

[0044] According to the experiment, that it is desirable setting up according to the flow rate and viscosity of a heated object made clear the degree of tilt angle of the heating units 21 and 22. Drawing 7 is drawing showing the chart which computes the degree of tilt angle of the heating units 21 and 22 (angle with the level surface to make) based on the value of a flow rate (a part for lit r/), and viscosity (cp), and the value which crosses on extension of the line which connected a flow rate and viscosity serves as the degree of tilt angle. For example, a flow rate is 0.5l., and if viscosity is 500cp(s), the degree of tilt angle will become 20 degrees.

[0045] Drawing 8 is drawing showing the control circuit for controlling the power supplied to electrodes 33 and 34, the detecting signal from the temperature sensor 87 prepared in the downstream of an electrode 33 is sent to a power conditioner 88, and the signal from the voltage setter 89 and the temperature setter 90 is sent to this power conditioner 88. Thereby, the voltage and current from a power supply 91 are adjusted to a predetermined value by the power conditioner 88, and are supplied to an electrode.

[0046] It is good also as a source power supply, or you may make it supply a RF generator as current supplied to electrodes 33 and 34. Moreover, if it totals three heating units 21–23 in illustrating, although 6 sets of electrodes are prepared, several sets are made into a source power supply, and be made to let other groups be RF generators. About the heating unit 48 for keeping warm, energization conditions are set up so that keeping-warm conditions may be fulfilled.

[0047] The following operations are made when heating the ingesta which have the fluidity which is a heated object with the heating apparatus which has the composition mentioned above.

[0048] First, a heated object is thrown in in a hopper 11 and the thrown-in heated object is made to breathe out in a heat exchanger 15 through a delivery pipe 14 with a pump 13. At this time, the pressure of a heated object turns into a pressure more than atmospheric pressure, and the pressure is detected by the pressure sensor 61.

[0049] The heated object heated by heat carriers, such as a steam, by heat conduction at about 90 degrees C flows in the heating unit 21–23 one by one with a heat exchanger 15. By supplying power between an electrode 33 and 34, the Joule's heat occurs and the heated object which flowed in the heating unit 21 is heated. If it heats by the Joule's heat generated in the heated object itself, it will be different from heating of a heat conduction type, the amount of [ in a duct ] core will go up quickly to necessary temperature, and generating of fault heating will be prevented.

[0050] A heated object is heated by 100 degrees C or more by holding the pressure in the heating unit 21 to the pressure more than atmospheric pressure. Thus, after performing preheating of a heat conduction type beforehand, by performing the Joule heating, a heated object can be quickly heated to the temperature of a request of 100 degrees C or more, and the Joule heating can be performed quickly.

[0051] Since three heating units 21–23 are formed and two pairs of heating units 26 and 27 are included in each heating unit 21–23 when illustrating, it can divide into six stages and temperature can be raised. The power supplied to each heating unit is controlled by the power conditioner 88.

[0052] Supply of power to electrodes 33 and 34 will be performed after the heated object has been full in the heating unit 21–23, and a heated object does not go up to predetermined temperature in the first stage which started heating apparatus. Therefore, \*\*\*-ed in the stag in early stages of starting is guided into the recovery tank 53. And after being in a steady state, the heated object which passed the heating units 21–23 and was heated by even predetermined temperature is guided into the product tank 54 by operating a cross valve 49. In addition, the heated object in the recovery tank 53 can be caudal discharged by operation

of a valv 67.

[0053] Although the pressur of this interior will b come high if the product tank 54 is mad into a lock out stat as a heated object flows in th product tank 54, even if a heat d object flows, the air in the product tank 54 is discharg d outsid through a pressur r gulator 64 from the gas pressur way 63 so that the pressure in th pr duct tank 54 may b maintained by the setting pressur . It is controlled so that the r covery tank 53 serves as a pred termi ned pr ssure similarly.

[0054] If it is det cted by level sensor 60b that th heated object flowed to pr det rmin d lev l in the product tank 54, it will suspend h ating operation and will discharg caudad by operation of a valve 68. However, two product tanks 54 are arranged, and if th heat d object after heating on on of product tanks is guided by operation of the cross valve which is not illustrat d, it can heat-treat continuously. Moreover, as product delivery pipe 52a shown in the branching pipe 52 with a two-dot chain line is connected, you may mak it convey dir ctly at the process which pours the ing sta after cooling into a bottle or a container.

[0055] As mentioned above, although invention made by this invention person was concretely explained based on the exempl , it cannot be overemphasized by this invention that it can change variously in the range which is not limited to the aforementioned example and does not deviate from the summary.

[0056] For example, although it has formed three heating units 21-23 in illustrating, only one heating unit is. Moreover, although it is made to include two pairs of heating units 27 and 28 in each heating unit 21-23, three or more pairs or any is sufficient as at least one pair. Furthermore, although it is made to conclude connections 24 and 25 by the member 26 for tubed r inforcement, you may make it conclude connections 24 and 25 using two or more rods. And although it is made to circulate through cooling water with the cooling water supply pipe 42 one by one to these in order to cool four electrodes prepared in each heating unit 21-23, respectively, as shown in drawing 4 , you may make it supply cooling water for each electrod with a s parate cooling water supply pipe.

[0057] Although a heat exchanger 15 is used and it is made to carry out preheating of the heated object by using a st am as a heat carrier in illustrating for preheating, you may make it heat at the heater using heating wire.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the outline block diagram showing the heating apparatus of one example of this invention.

[Drawing 2] It is the front view showing the supporter material for supporting two heating units shown in drawing 1.

[Drawing 3] It is the perspective diagram showing a joint.

[Drawing 4] It is the cross section showing a heating unit.

[Drawing 5] It is the perspective diagram showing the heating unit which constitutes a heating unit.

[Drawing 6] The cross section in which (A) shows other examples of an electrode, and (B) are the side elevations of this drawing (A).

[Drawing 7] It is drawing showing the chart for computing the degree of tilt angle of a heating unit.

[Drawing 8] It is the control circuit view which controls the power supplied to an electrode.

[Description of Notations]

11 Hopper

12 Level Sensor

13 Pump

14 Delivery Pipe

15 Heat Exchanger

16 Steamy Supply Pipe

17 Steamy Exhaust Pipe

21-23 Heating unit

24 25 Connection

26 Tubed Reinforcement — Member

27 28 Heating unit

32 Heating Cylinder Object

33 34 Electrode

36-38 Spacer

39 Packing

41 Cavity

42 Cooling Water Supply Pipe

43-47 Joint

48 Heating Unit for Keeping Warm

49 Cross Valve

51 52 Branching pipe

53 Recovery Tank

54 Product Tank

55a, 55b Condensator

57 Cooling Water Jacket

61 Pressure Sensor

62 Source of Gas Pressure

63 Gas Pressure Way

64 Pressure Regulator

65 Opening-and-Closing Valve

71 72 Elbow pipe

77 Clamp — Member

81 Supporter Material

87 Temperature Sensor

88 Power Conditioner

89 Voltage Setter

90 Temperature Setter

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[Translation done.]

\* NOTICES \*

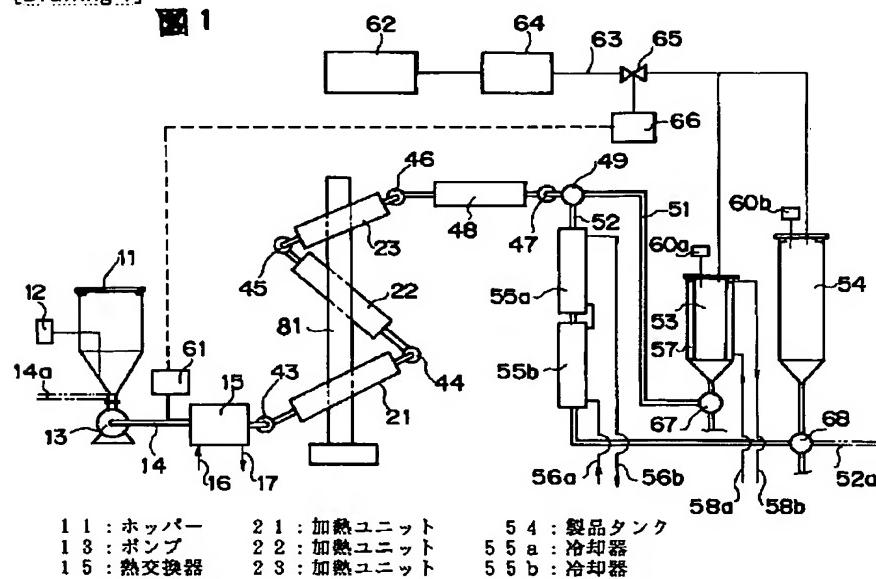
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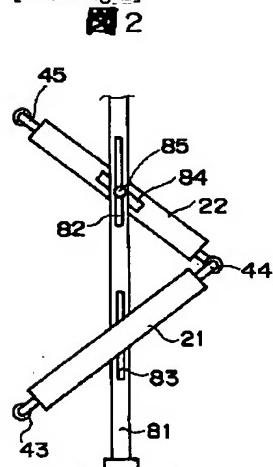
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DRAWINGS

[Drawing 1]

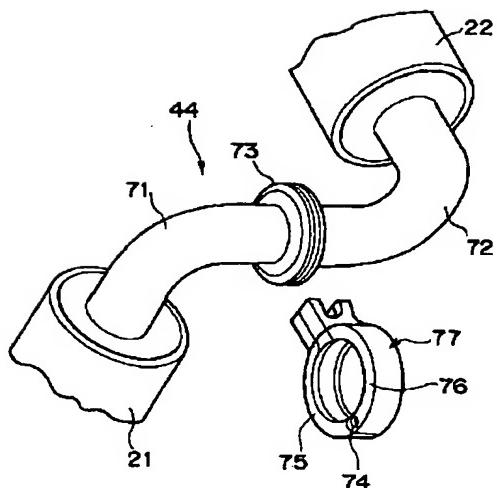


[Drawing 2]



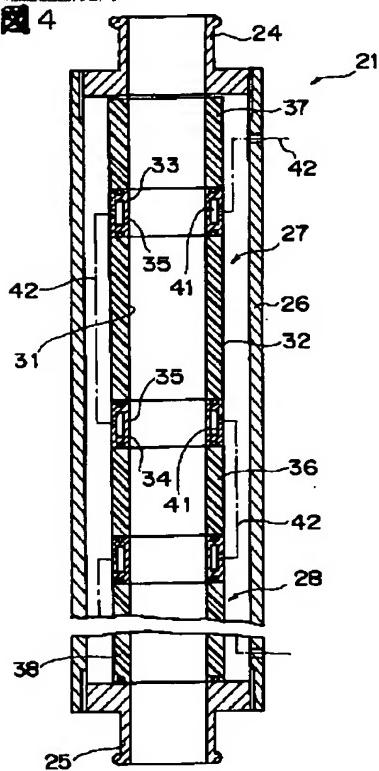
[Drawing 3]

図 3



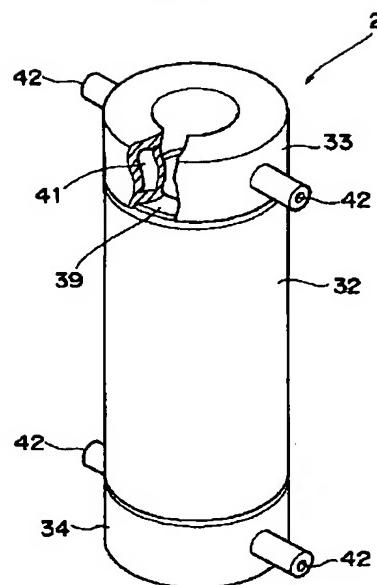
[Drawing 4]

図 4



[Drawing 5]

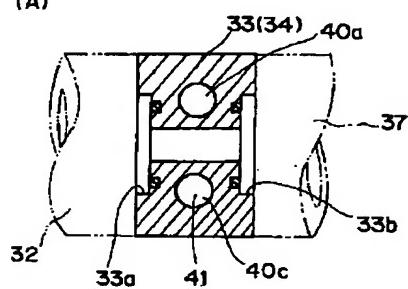
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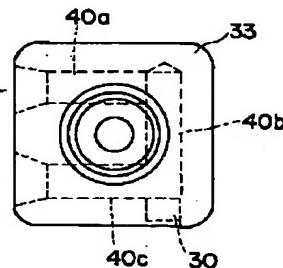
[Drawing 6]

図6

(A)

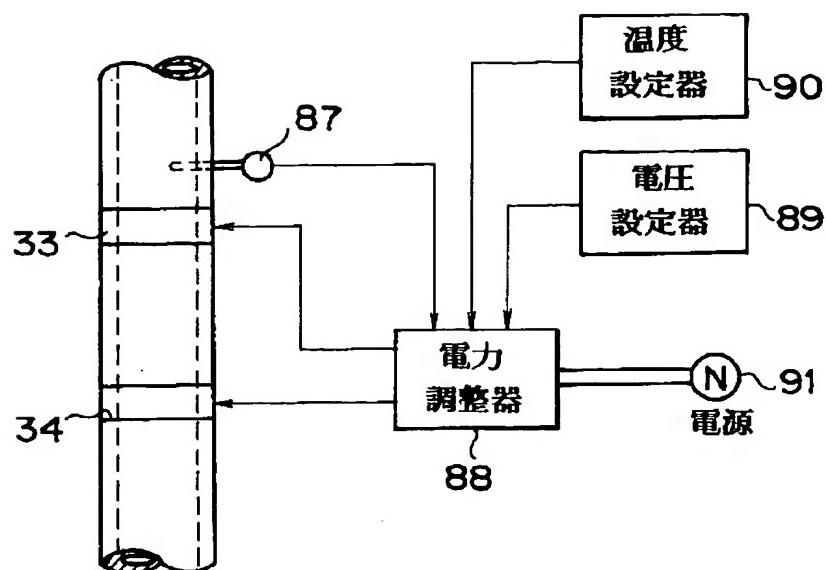


(B)



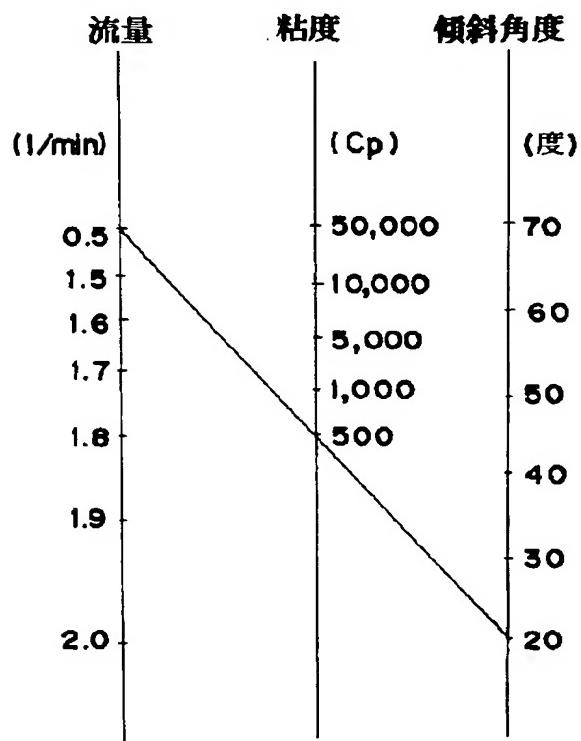
[Drawing 8]

図 8



[Drawing 7]

図 7



[Translation don.]